CI4000 Series
PXI CW RF Synthesizers

User Guide and Installation Manual

Cambridge Instruments, A Division of MagiQ Technologies, Inc.

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About This Manual

This guide explains how to install, configure, test, and begin using a Cambridge Instruments (CI) radio frequency synthesizers CI4061/4062/4122 . For the most recent versions of documentation and the latest version of the driver and software, visit http://www.cambridgeinstruments.com .

Safety Information

Do not substitute parts or modify the hardware except as described in this document. Use the hardware only with the chassis, modules, accessories, and cables specified in the installation instructions or specifications. All covers and filler panels should be installed during operation of the hardware.

This product is intended for use in industrial and scientific locations. However, harmful interference may occur in some installations, when the product is connected to a peripheral device or test object, or if the product is used in residential or commercial areas. To minimize interference with the reception of radio and television broadcasts, install and use this product in strict accordance with the instructions in the product documentation.

Any modifications to the product not expressly approved by Cambridge Instruments could void your authority to operate it under your local regulatory rules.

Compliance and Safety Standards

EMI / EMC Compliance:

Cambridge Instruments products comply by test and design with the requirements listed below:

- European EMC Directive 2004/108/EC
- EN 61000-4 (Sections 2, 3, 4, 6)
- IEC/EN 61326-2-1 (for sensitive test and measurement equipment for EMC unprotected applications)
- CISPR Pub 11 Group 1, class A
- AS/NZS CISPR 11
- ICES/NMB-001
- Canadian ICES-001.

RoHS Compliance:

Cambridge Instruments products are in compliance with Directive 2002/95/EC of the European Parliament and the Council of 27 January 2003 on the Restriction and use of Certain Hazardous Substances in Electrical and Electron Equipment (RoHS Directive).

Safety Compliance:

Cambridge Instruments products meet the relevant safety requirements of UL/CSA/EN/IEC 61010. This confirms the flame ratings of critical components and materials. The testing performed insures that no excessive temperatures can exist in the equipment that could become a fire hazard.

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Contact Information

For sales questions please contact us at:

Cambridge Instruments,
330 Changebridge Rd, Suite 101,
Pine Brook, NJ 07058 USA
www.cambridgeinstruments.com
Tel: +1-617-863-7948
Email: sales@cambridgeinstruments.com

For support and technical questions please contact us at:

Cambridge Instruments,
11 Ward Street, Somerville, MA 02143
www.cambridgeinstruments.com
Tel: +1 617-863-7948
Email: support@cambridgeinstruments.com

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Contents

Chapter 1

Hardware Overview

1.1 Hardware

Cambridge Instruments CW RF Synthesizers come in three different configurations: 4061, 4062, and 4122.

1.2 CW RF Synthesizer CI 4061

CI 4061 is a single channel CW RF Synthesizer.

- **Channel 1** can provide RF signal in the 75MHz-6GHz frequency range. The LED under the channel when green indicates an active output frequency that is locked to the reference.
- **REF** is an Reference input port for an external clock. The LED under the Reference port is not being used.

1.3 CW RF Synthesizer CI 4062

CI 4062 is a dual channel CW RF Synthesizer. Channel 1 and Channel 2 are identical.

- **Channel 1** can provide RF signal in the 75MHz-6GHz frequency range. The LED under the channel when green indicates an active output frequency that is locked to the reference.
- **Channel 2** can provide RF signal in the 75MHz-6GHz frequency range. The LED under the channel when green indicates an active output frequency that is locked to the reference.
- **REF** is an Reference input port for an external clock. The LED under the Reference port is not being used.

1.4 CW RF Synthesizer CI 4122

CI 4122 is a dual channel CW RF Synthesizer. Channel 1 and Channel 2 are NOT identical.

- **Channel 1** can provide RF signal in the 75MHz-6GHz frequency range. The LED under the channel when green indicates an active output frequency that is locked to the reference.
- **Channel 2** can provide RF signal in the 6GHz-12GHz frequency range. The LED under the channel when green indicates an active output frequency that is locked to the reference.
- **REF** is an Reference input port for an external clock. The LED under the Reference port is not being used.

Chapter 2

CI 4000 Series Theory of Operation

Each channel of the Cambridge Instruments 4000 series synthesizers is based on a single MMIC synthesizer which creates a high fidelity, low phase noise RF output. This MMIC incorporates a phase locked loop (PLL) architecture and integrated VCO technology. The output is then filtered and amplified to further improve the fidelity of the signal. An analog microwave attenuator is used to level the power which results in an accurate user programmable output. The attenuator setting for any requested output power is calculated from a calibration table which corrects for both frequency and temperature variations. In the case of the 4122 12 GHz channel, the output of the MMIC based synthesizer is doubled before filtering, amplification and leveling. An FPGA is used to interface with the PXI Express backplane and controls the MMIC based synthesizer as well as the various filter switch paths. Depending on the power level requested, the instrument performs an interpolation of the calibration data and sends the appropriate values to the digital to analog converter used with the analog microwave attenuator.

The synthesizer requires a stable frequency reference for the PLL MMIC. This frequency reference will determine the overall frequency stability as well as the phase noise inside the loop bandwidth of the PLL (typically <100 KHz). The 4000 series provide three options for the reference frequency source. There is a low phase noise 50MHz internal reference (default). The user can select the PXI backplane 10MHz which is useful when sharing the same frequency reference between multiple PXI modules however this source is noisy as compared to the internal reference. The user can also provide an external reference from 10 MHz to 200 MHz via the REF IN/OUT SMA connector. Finally the REF IN/OUT SMA connector can be configured as an output only when the internal reference is selected which allows the user to share this internal reference with other modules.

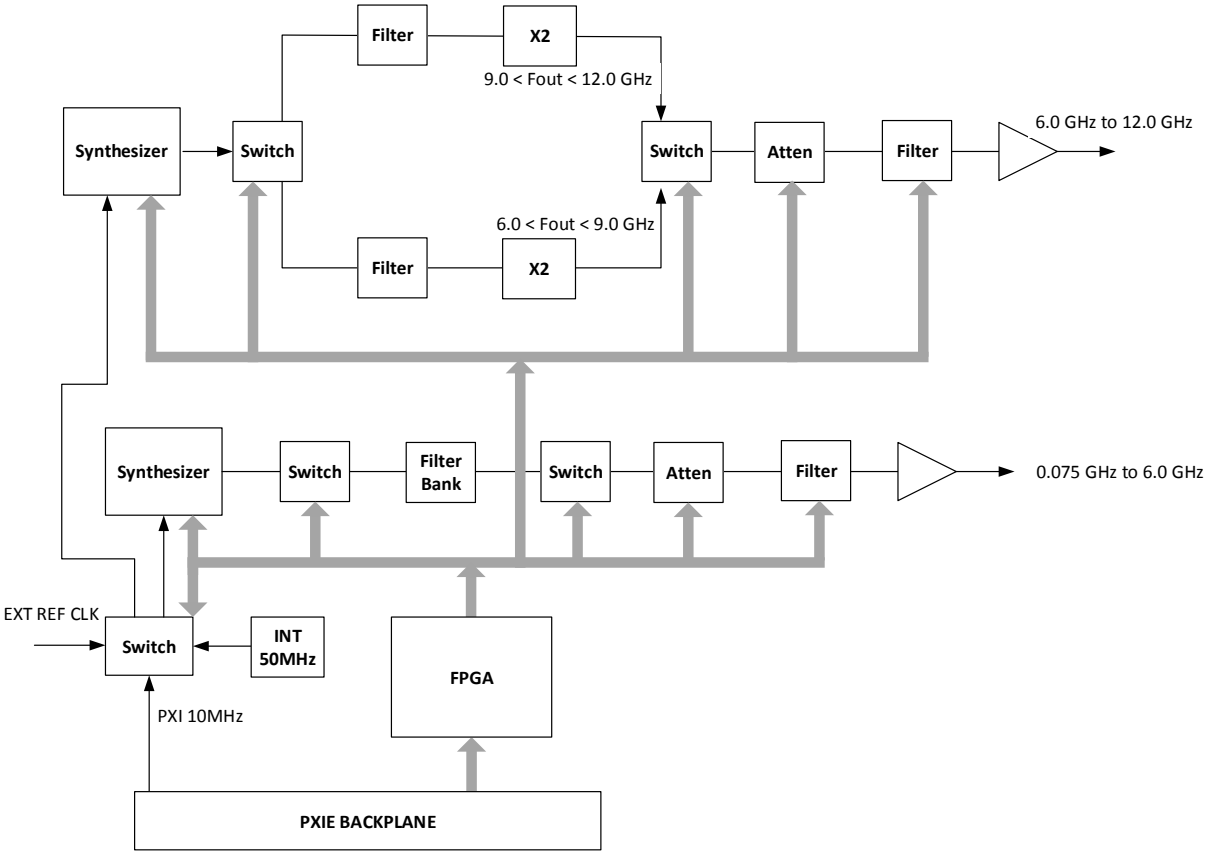
The overall output frequency resolution is dependent on the reference frequency that is used. It is also dependent on the output bandwidth of the synthesizer based on the fact that the MMIC incorporates an internal VCO whose fundamental output is 1.5 to 3 GHz and all other frequencies are either divided down versions of this band or multiplied by two or four for the frequencies above 3 GHz. The following calculation will determine the output frequency resolution as a function of reference frequency and VCO band.

$$F_{res} = \frac{F_{ref}}{2^{22+N}} \tag{2.1}$$

Where N is the frequency band relative to the VCO fundamental band of 1.5 to 3 GHz. Examples of the output frequency resolution for various N and Reference frequencies is shown in the table 2.1.

Table 2.1: OUTPUT FREQUENCY RESOLUTION TABLE

Reference Frequency	Resolution [Hz] for 375-750MHz	Resolution [Hz] for 0.75-1.5GHz	Resolution [Hz] for 1.5-3GHz	Resolution [Hz] for 3-6GHz	Resolution [Hz] for 6-12GHz
N =	4	3	2	1	0
10 MHz	0.15	0.30	0.60	1.19	2.38
50 MHz	0.75	1.49	2.98	5.96	11.92
80 MHz	1.19	2.38	4.77	9.54	19.07


Filter
X2
9.0 < Fout < 12.0 GHz
Synthesizer
Switch
Switch
Atten
Filter
6.0 GHz to 12.0 GHz
6.0 < Fout < 9.0 GHz
Filter
X2
Synthesizer
Switch
Filter Bank
Switch
Atten
Filter
0.075 GHz to 6.0 GHz
EXT REF CLK
Switch
INT 50MHz
FPGA
PXI 10MHz
PXIE BACKPLANE

Chapter 3

Installing the CI4061/4062/4122 RF Frequency synthesizer

3.1 Unpacking

All Cambridge Instruments (CI) PXI Express hardware modules ship in antistatic bags to prevent damage from electrostatic discharge (ESD). ESD can damage several components of the CI PXI Express modules, so store all CI PXI Express hardware modules in the antistatic bags when not in use.

Caution Never touch exposed connector pins.

To avoid damage when handling CI PXI Express modules take the following basic precautions:

- Ground yourself using a grounding strap or by touching a grounded object.
- Touch the antistatic package to a metal part of the PXI Express chassis before removing the hardware module from the package.

Remove each hardware module from its package, and visually inspect it for loose components or any other signs of damage. Contact CI (support@cambridgeinstruments.com) if the hardware module appears damaged in any way. Do not install a damaged module into the system as it may cause further damage to the module or the system.

3.1.1 Kit Contents

Your kit includes CI RF synthesizer PXIe module only. You need the following items to set up and use the RF Frequency Synthesizer.

- CI PXI Express modules
- Manuals, drivers, and software that are available in the download section of http://www.cambridgeinstruments.com .

3.2 Installing the CI4061/4062/4122

It is recommended that you install the drivers before installing the hardware. See the chapter 4 for the instructions on software installation.

3.2.1 Identifying PXI Express slots

Installing the CI4061/4062/4122 synthesizer requires one vacant PXI Express slot. Review the chassis documentation to find out which slots are designed to accept PXI Express modules. Table 3.1 provides guidelines on how to recognize slots that are capable of accepting PXI Express modules.

Table 3.1: PXI/PXI Express Compatibility Glyph

	CI 4000 series synthesizers will **NOT** work in these slots.
	You can install PXI/PXI Express modules in any PXI hybrid slot marked with a peripheral slot compatibility glyph (the letter 'H' and a solid circle containing the slot number). CI 4000 series synthesizers will work in these slots.
	You can install PXI Express modules in any PXI Express slot marked with a peripheral slot compatibility glyph (a solid circle containing the slot number). CI 4000 series synthesizers will work in these slots.

3.2.2 Installation Steps

To install a PXI Express module, complete the following steps:

Caution Power off and unplug the chassis before installing the device. It is highly recommended to unplug the chassis.

1. Power off and unplug the PXI/PXI Express chassis.
2. If the chassis has multiple fan speed settings, ensure the fans are set to the highest setting.
3. Ensure the PXI/PXI Express chassis inlet and outlet vents are not obstructed. The chassis documentation should provide more information about optimal clearances and airflow. Read **??** for air cooling guidelines.
4. Put the ejector handle is in the unlatched (i.e. downward) position.
5. Hold the module by the ejector handle and slide it into an empty compatible slot. Ensure the card aligns within the guides in the chassis.
6. After sliding the module completely into the chassis, latch it by pulling up on the ejector handle.
7. **Important:** Tighten the captive screws at the top and bottom of the module front panel.
8. Verify that the PXI/PXI Express chassis fans are operable and free of dust, contaminants or blockages that may restrict airflow.
9. Cover all empty PXI/PXI Express slots using PXI/PXI Express filler panels and filler panels cover the front of the chassis; fillers fill the slot area so air doesn't just blow straight through.
10. Plug in and power on the PXI/PXI Express chassis.

3.3 Cable Connection Guidelines

Observe the following guidelines to ensure proper installation and use of SMA cables:

Note Check to make sure that center pin is not bent. Do not excessively bend the cables as they can be damaged.

- Hand-tighten the SMA cable end onto the SMA connector after the cables are correctly aligned and connected. The cable connectors should tighten without much torque or effort.
- Use an 3-5 in.lbf in (0.3-0.6 N.m) torque wrench (not included) to complete the tightening of the SMA cable.

Caution To ensure the specified EMC performance, operate this product only with well shielded coaxial cables and accessories.

3.4 Maintaining PXI Express Modules

Some chassis include fan filters. Cleaning the fan filters on the chassis regularly can prevent fan blockage and ensure efficient air circulation. Keep the module free of dust by cleaning with compressed air. Do not clean solvents or liquids. The required cleaning frequency depends on the amount of use and the operating environment.

Do not expose the module to temperatures or humidity beyond the rated maximums. For information about the rated maximums, refer to your device specifications document.

3.5 Cooling Considerations

Use the following guidelines to maintain optimal forced-air cooling for PXI/PXI Express devices.

Caution Inadequate air circulation can cause the temperature inside a PXI, PXI Express, or PC chassis/case to rise above the maximum recommended operating temperature for your device, potentially causing thermal shutdown or damage to the device. Refer to your chassis documentation for more information about air circulation paths, fan settings, space allowances, and cleaning procedures.

- Cambridge Instruments highly recommends installing slot blockers in unused slots to maximize air flow in the slots populated with devices.
- Install filler panels over all unused slots after installing your devices. Missing filler panels disrupt the necessary air circulation in the chassis.
- Allow plenty of space around the chassis fan intake and exhaust vents. Blocked fan vents impede the air flow needed for cooling. If you remove the chassis feet, allow for adequate clearance below the chassis. Refer to your chassis user manual for further information about fan location, chassis orientation, and clearances.

Often, ambient temperature is a concern for rack-mount deployments. If your PXI system is deployed in a rack, the following guidelines should be considered:

- Place high-power units within the rack above the PXI system(s) where possible.
- Use racks with open sides and/or rear panels.

- Use fan trays within the rack, and at the top and bottom of the rack, to increase overall air flow. This will reduce ambient temperatures within the rack.
- Use other methods that reduce ambient temperatures within the rack.

3.6 Uninstalling PXI Express Modules

Power-off the chassis before removing a PXI Express module from the chassis. Use a grounding strap or otherwise ensure you are grounded when removing PXI Express modules from the chassis. To avoid ESD damage, do not touch the exposed pins of the PXI Express connector or any exposed circuitry on the module. When not in use, PXI Express modules should be stored in the original antistatic bag to avoid damage.

Hot Surface During operation, the metal surfaces of a PXI Express module may become hot. When removing or moving a module, hold the module only by the ejector handle and front panel.

Chapter 4

Software Installation

CI4061/4062/4122 drivers support Windows™XP, Win7, 8, and 8.1 operating systems. Please contact Cambridge Instruments (support@cambridgeinstruments.com) for other operating system support.

The drivers make use of VISA programming interface. NI-VISA™is available from National Instruments Corporation (www.ni.com).

IVI (Interchangeable Virtual Instruments) shared components (http://www.ivifoundation.org/) have to be installed to use the CI4061/4062/4122 IVI drivers.

Important VISA must be installed before installing CI4061/4062/4122 drivers. IVI shared components are optional but they have to be installed if you are intending to use CI4061/4062/4122 IVI drivers.

4.1 Device Driver Architecture and Software Dependencies

The CI4061/4062/4122 module is programmed through the API library functions that are contained in the core driver called CICW, see Figure 4.1. The CICW API is provided as a dynamic linked library, CI4000.dll. This API uses VISA to communicate with the device.

CI4061/4062/4122 drivers also include IVI-C and IVI.NET support. The IVI interface is provided in the same CI4000.dll library and is dependent on the core driver CICW (see Figure 4.1).

Cambridge Instruments provide LabVIEW™VIs and example programs. The LabVIEW™VIs use the IVI interface and requires the IVI drivers to be installed on the system.

The next section walks through the software installation steps. The driver file locations are summarized in Figure 4.2.

System Diagram

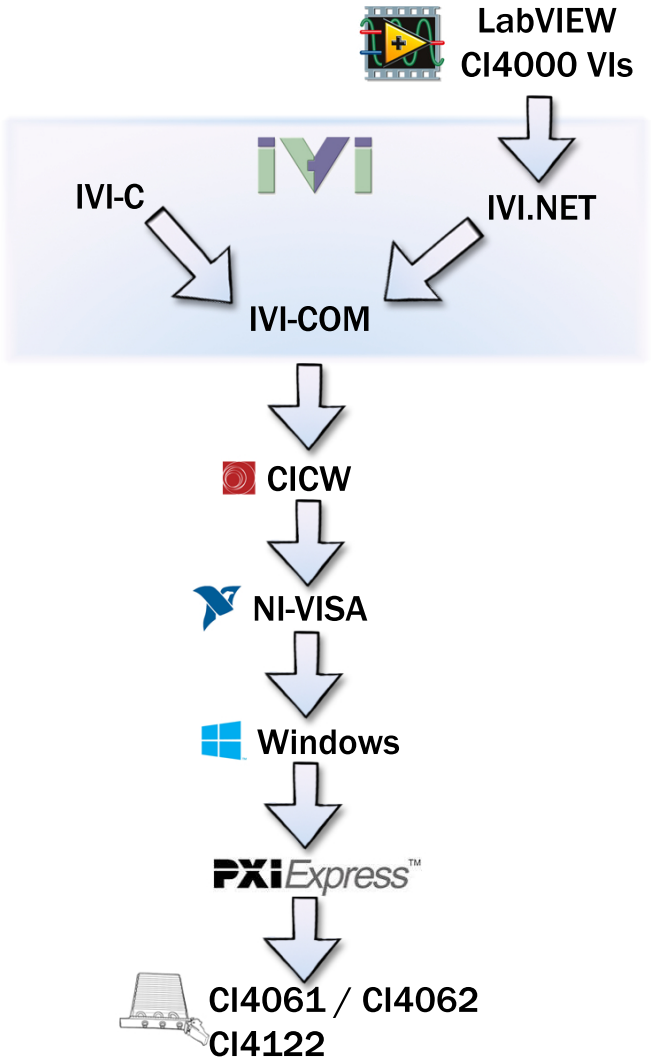


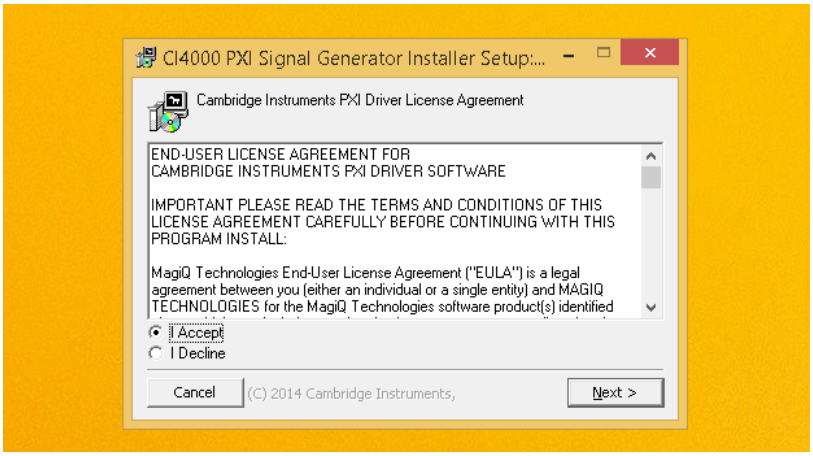
Figure 4.1: CI4000 Flow of Control.

4.2 Installation of the CI4061/4062/4122 Driver and Software

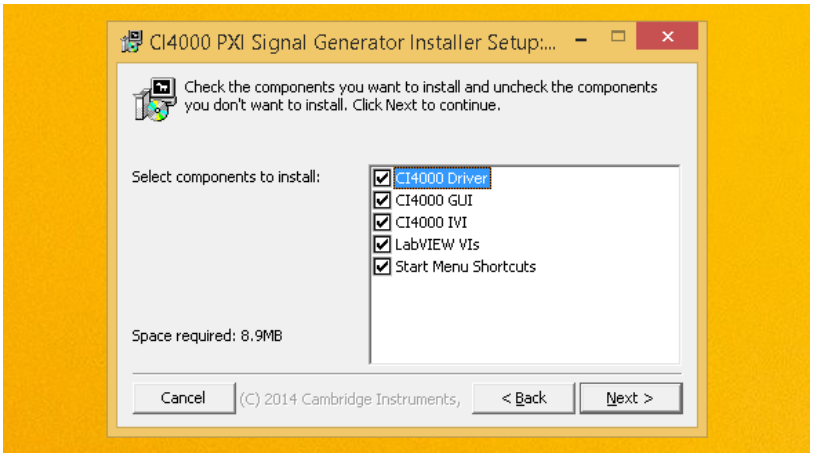
You need to have IVI shared components installed on your computer for the CI4000 IVI driver to operate. You can download the components from http://www.ivifoundation.org/shared_components/.

Download the CI4000 software installer (CI4000_Install_rxxx.exe) from http://cambridgeinstruments.com/downloads/ and then execute the CI installation program.

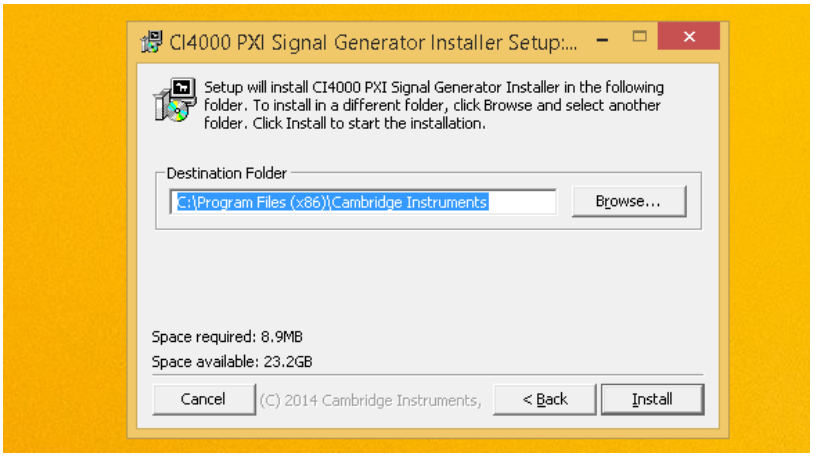
Step 1 Select 'I Accept' and press Next to accept the installation of the software.



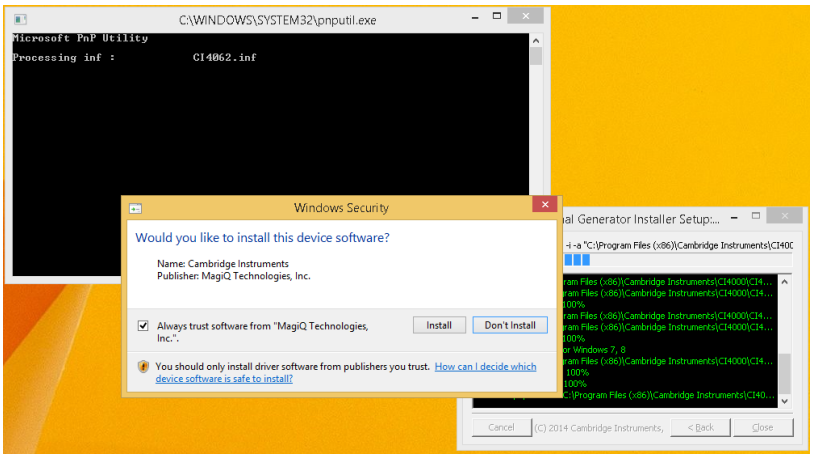
Step 2 Choose the software options you want to have installed on your system. Everything selected is the default option. **Note:** you have to install CI4000 IVI driver if you plan to use the LabVIEW™ VIs. Press Next.



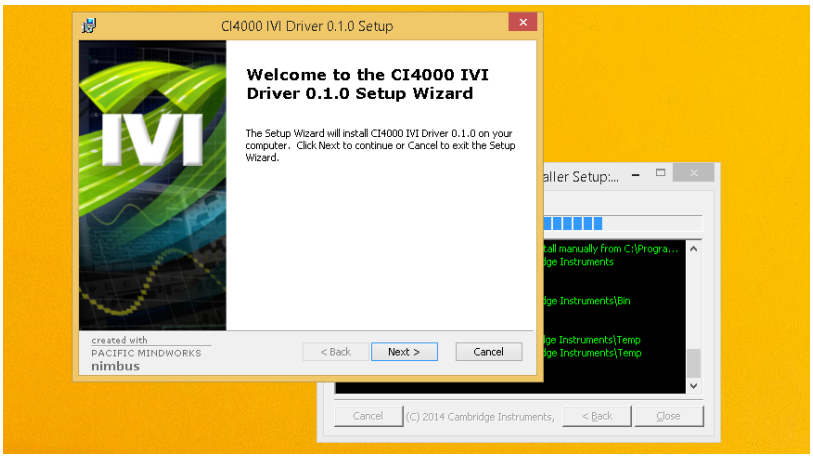
Step 3 Please choose the path you want to install the software and press Install.



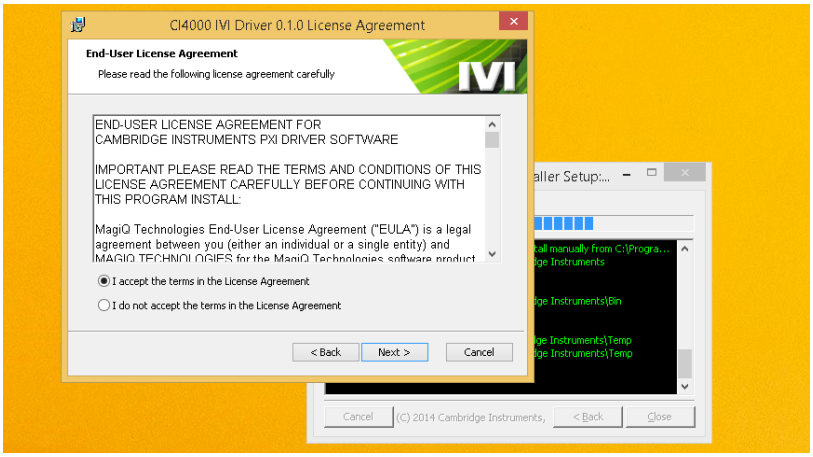
Step 4 It is recommended to select 'Always trust' option; otherwise you might see other similar screen asking to accept the installation. Press Install. **Note:** MagiQ Technologies, Inc. is the parent company of Cambridge Instruments.



Step 5 Press Next.



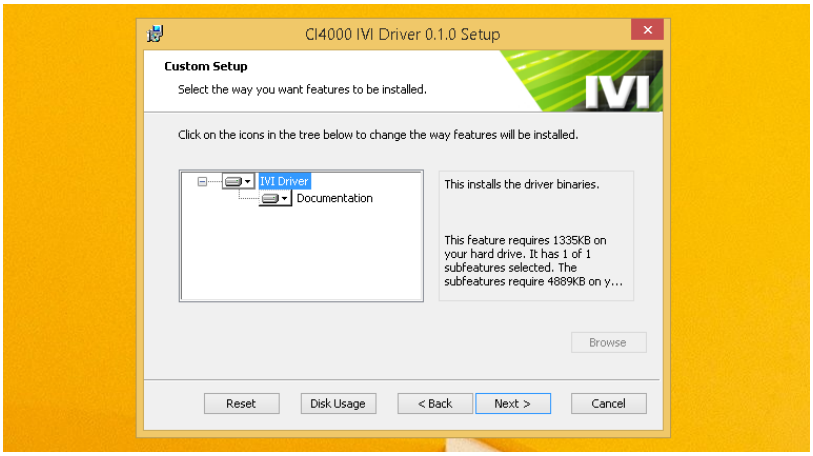
Step 6 Read and accept the license Agreement. Press Next.



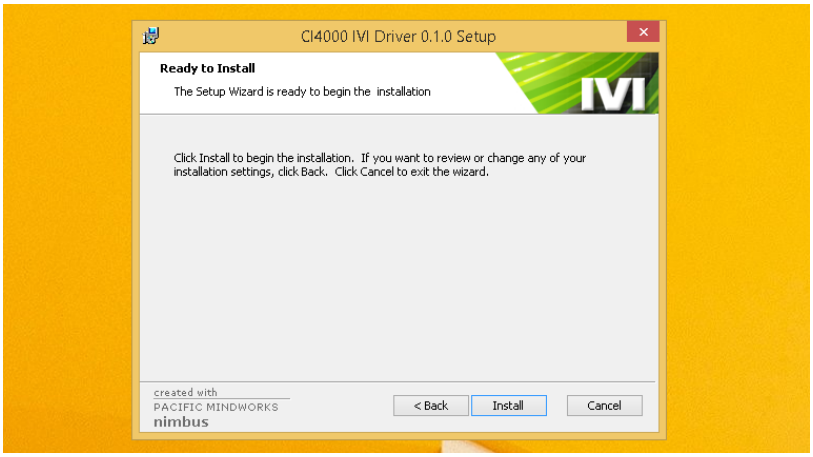
4.2.1 IVI shared components are already installed on the computer

You should proceed to subsection 4.2.2 if IVI shared components are missing on your computer. You will see the steps 8-10 of this section only if the IVI shared components are already installed on your computer.

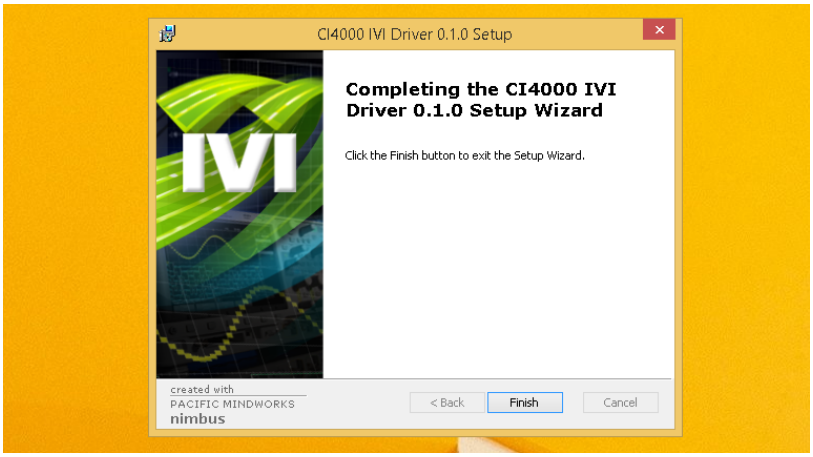
Step 8 It is recommended that you install CI4000 IVI driver documentation. Press Next.



Step 9 Press Install.



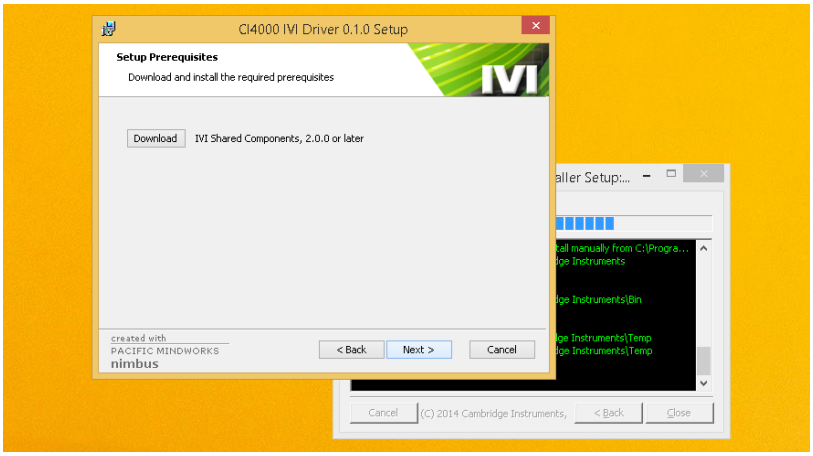
Step 10 The installation is done. Press Finish.



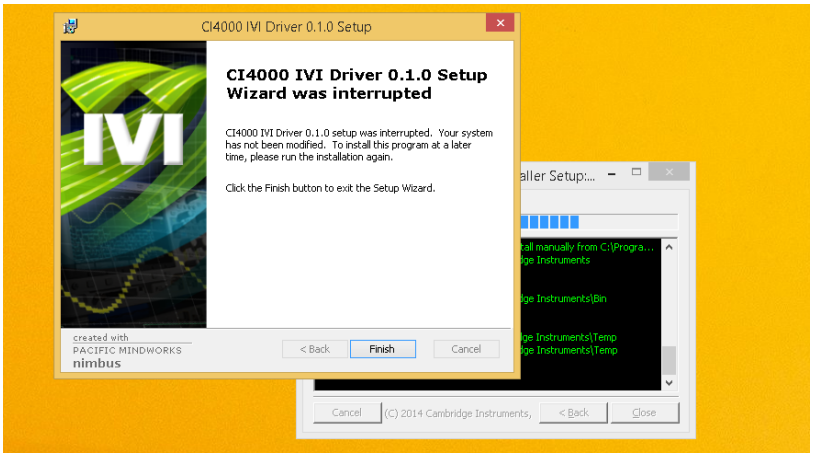
4.2.2 If IVI shared components are missing

IVI shared components are required for the CI4000 IVI driver. You are provided an opportunity to download the components in step 8a.

Step 8a Press download to download the IVI shared components. Remember the location of the download. Press Next.



Step 9a Press Finish



IVI driver was not installed on your system. At this point you have to install the IVI shared components you downloaded in step 8a. Go to the download location and run the IVI shared component installation program. After that run the CI4000 installer again.

Important At this point CI4000 driver is still not installed. You have to rerun the CI4000 installer and folow the steps of section 4.2.

4.3 System Diagram with File Locations

Figure 4.2 summaries the typical file locations after the software installation.

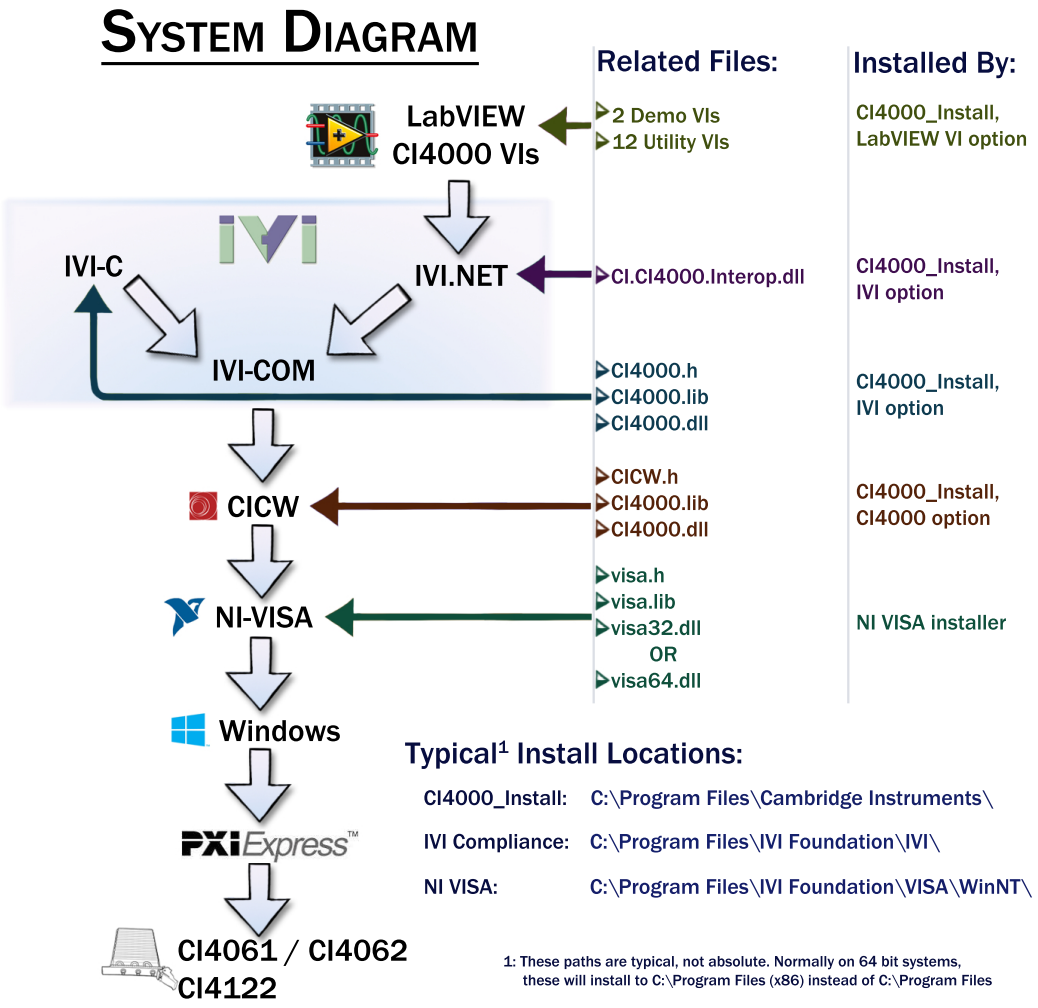


Figure 4.2: Location of the driver files after the software installation. This figure assumes that the default file paths were using during the installation of the drivers.

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Chapter 5

Graphical User Interface (GUI)

CI4061/4062/4122 Graphical User Interface can be found under in Windows™Start menu; look for CI4000_GUI icon.

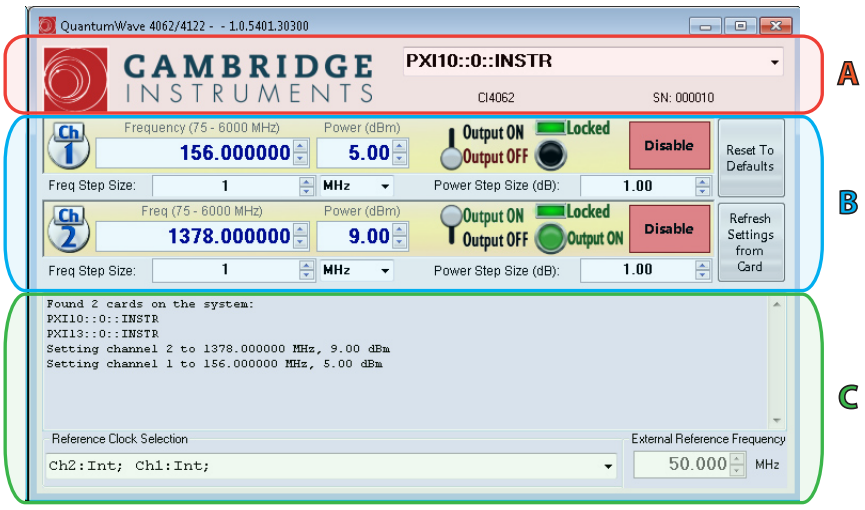


Figure 5.1: CI4061/4062/4122 GUI consits of three sections. A) Module selection, if you have several modules installed they will all appear in the drop down menu B) Synthesizer Control Section c) Output Log and Reference Oscillator

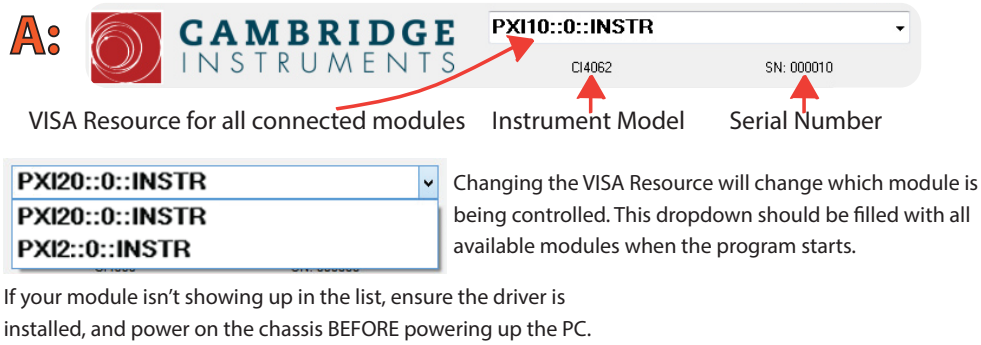
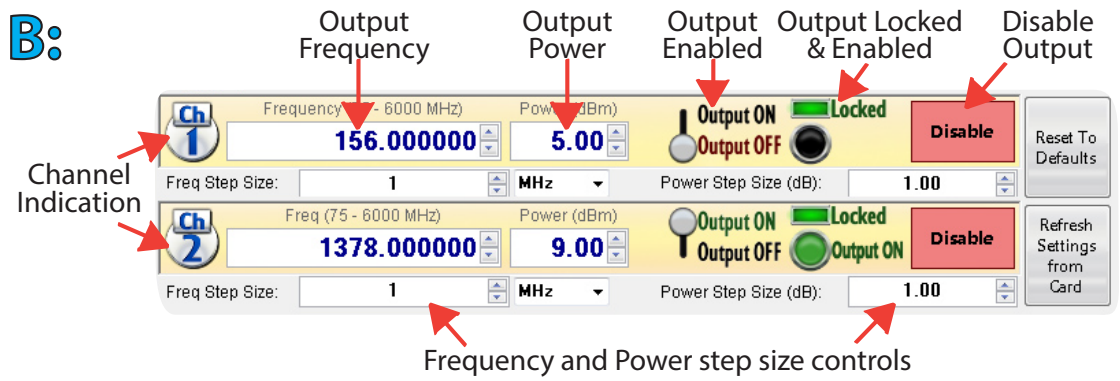


Figure 5.2: A) Module selection section.



When connected to a card, each channel will have it's own set of controls, indicated on the left of the GUI.

Pressing Reset will disable the output on both channels, and set the frequencies and powers to their default values.

Pressing Refresh will read all of the settings off of the module, and fill in the GUI with the current settings

Setting the output on your Synthesizer

Each channel has 3 inputs to set the power, frequency, and output. Changing any of these will immediately change the settings on the synthesizer.

Frequency:

Frequency will allow down to 1Hz resolution. Max and min limits for the card are as follows:
Ch1 4062 - Min: 75 MHz, Max: 6000 MHz
Ch1 4122 - Min: 6000 MHz, Max: 12000 MHz

Power:

Power is the output power level in dBm. Power levels between -20 and +20 are accepted, but only power levels between -10 and +10 are part of the specifications, and values outside of that range are not guaranteed to be accurate.

Output ON / Output OFF:

This is either ON or OFF, clicking it will change from one state to the other.

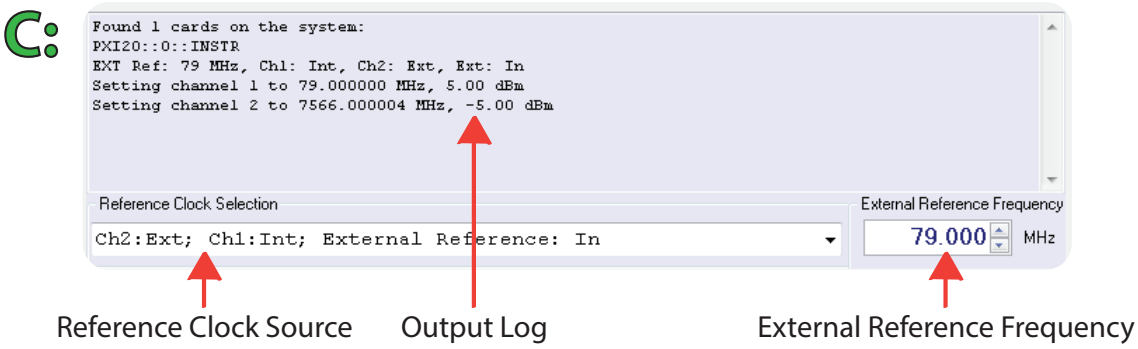
Lock & Output Indicator:

This is not a control, it's an indication of the card's current state. There are 2 parts to the icon: The top is if the PLL is Locked or Unlocked, while the bottom is if the card is currently outputting RF. There are two additional states, Uncal High and Uncal Low. These appear if output is on, but the set Frequency and power level are either above or below the calibrated range, and hardware is unable to output it.

Indicators of the current Locked state:

Indicators of the current RF output:

Figure 5.3: B) Synthesizer control section

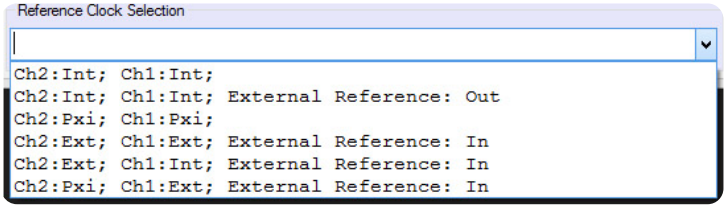


Output Log

The output log is a running display of everything that the GUI has been used for since coming up.

- Tells you when the selected module was switched
- Shows the channel, frequency, and power that was set to the card
- Gives you changes to the Reference Clock
- If any errors should arise, it will display the error and possible reasons.

Setting the Reference Source and Frequency



Ch 1 Internal, Ch 2 Internal:
This setting will use the Internal 10 MHz reference for both channels. External Reference port is unused.

Ch 1 Internal, Ch 2 Internal, External Reference Out:
This will also use the Internal reference for both channels, and will output the internal reference from the External Reference port.

Ch 1 PXI, Ch 2 PXI:
Both channels will use the PXI 50 MHz clock. External Reference port is unused.

Ch 1 External, Ch 2 External:
Both channels will use the the signal coming into the External Reference port as their reference clocks.

Ch 1 Internal, Ch 2 External:
Channel 1 will use the Internal 10 MHz reference, while channel 2 will use the signal input from the External Reference port.

Ch 1 External, Ch 2 PXI:
Channel 1 will use the External Reference with this setting, while channel 2 will use the 50 MHz PXI source.

Figure 5.4: C) Output Log and Reference Oscillator section.

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Chapter 6

Programming Interfaces

CI4061/4062/4122 can be controlled using CICW (Cambridge Instruments Continuous Wave) API; the latter API (dynamic link library CI4000.dll) is issuing commands over the VISA interface . You can also use CI4061/4062/4122 IVI (Interchangeable Virtual Instruments) interface (implemented in the same dynamic link library CI4000.dll) to control the modules; see Figure 4.2.

6.1 Choosing the Right Interface: IVI or CICW?

Depending on the language you are using, the choice may be relatively straight forward. For instance, if you are using a .NET oriented language you may find the IVI.NET interface to be most useful. If you are using C or C++ and want the additional standardization of IVI then IVI-C may be your interface of choice. If you are using C or C++ and want a minimum of overhead and additional software to configure, then the CICW (Cambridge Instruments Continuous Wave) interface may be the best choice.

Feature	IVI.NET	IVI-C	CICW
Already Using IVI	✓	✓	
Minimal learning curve			✓
Ease of deployment			✓
LabVIEW™	✓		
LabWindows		✓	✓
C#/Visual Basic	✓		
MinGW		✓	✓

IVI addresses many concerns of large automated test floors, including support for inconsistent equipment models from one test stand to the next. www.ivifoundation.org lists many other benefits. However, IVI requires additional software and complexity to support this. The IVI.NET and IVI-C interfaces are built on IVI-COM which requires the driver to be properly registered, IVI style, in order for it to be recognized. Compatible versions of the IVI Shared Components (IVI 2.0+) and VISA must be installed. Because the CI4000 IVI drivers are installed in the path, in the registry, and in the Global Assembly Cache, multiple versions of the same driver are not supported on the same machine.

The CICW interface is a thin, minimal driver with few configuration options and few dependencies. It is possible to deploy a CICW driver by copying CI4000.dll into the same directory as the rest of the project binaries. The hardware must still be recognized by the test system (requires VISA and the CI4000 Driver to be installed) but different programs can use different versions of CI4000.dll on the same system as needed, whether when trying new software or just to ensure existing programs continue to work **exactly** the same way.

6.2 Straight 'C' CICW Interface

Please refer to CI4000 'C' Programming Interface manual for the instructions on how to use CI4000 driver in your C, C++, LabVIEW™, etc. applications.

6.3 IVI Interface

Please refer to CI4000 IVI Programming Interface manual if you are using IVI infrastructure to control the CI4061/4062/4122 modules.

Appendix A provides some important details on configuring your IVI using NI-MAX™utility.

6.4 LabVIEW™

CI4061/4062/4122 synthesizers can be programed using NI LabVIEW™.

Important LabVIEW programs provided with CI4061/4062/4122 installation package reguire IVI driver (see Figure 4.1); make sure that you select IVI driver option when installing the package.

See Appendix B for the details on how to access CI4061/4062/4122 LabVIEW™VIs and examples.a

Note: You could use the CI4000.dll and LabVIEW™'s Function Node to control the CI4061/4062/4122 synthesizers through CICW API. More details can be found here: How Do I Call a Dynamic Link Library (DLL) from LabVIEW?

Appendix A

IVI Configuration Using NI MAX

NI MAX is a utility supplied with NI VISA for setting up the IVI Configuration Store, which maps names to physical instruments and provides configuration information for those instruments. If you have a different VISA vendor, please consult your VISA documentation for the specifics; the underlying IVI capabilities are the same.

IVI allows you to define "Logical Names" for your instruments to make your program easier to read and to allow instruments to be exchanged transparently to the program. Suppose you want your CI4000 to drive "LO1" and "LO2" in your system, where LO1 comes from CI4122 channel 1 and LO2 comes from channel 2.

Find your hardware by bringing up NI MAX and expanding "Devices and Interfaces" and the PXI Chassis, Figure A.1.

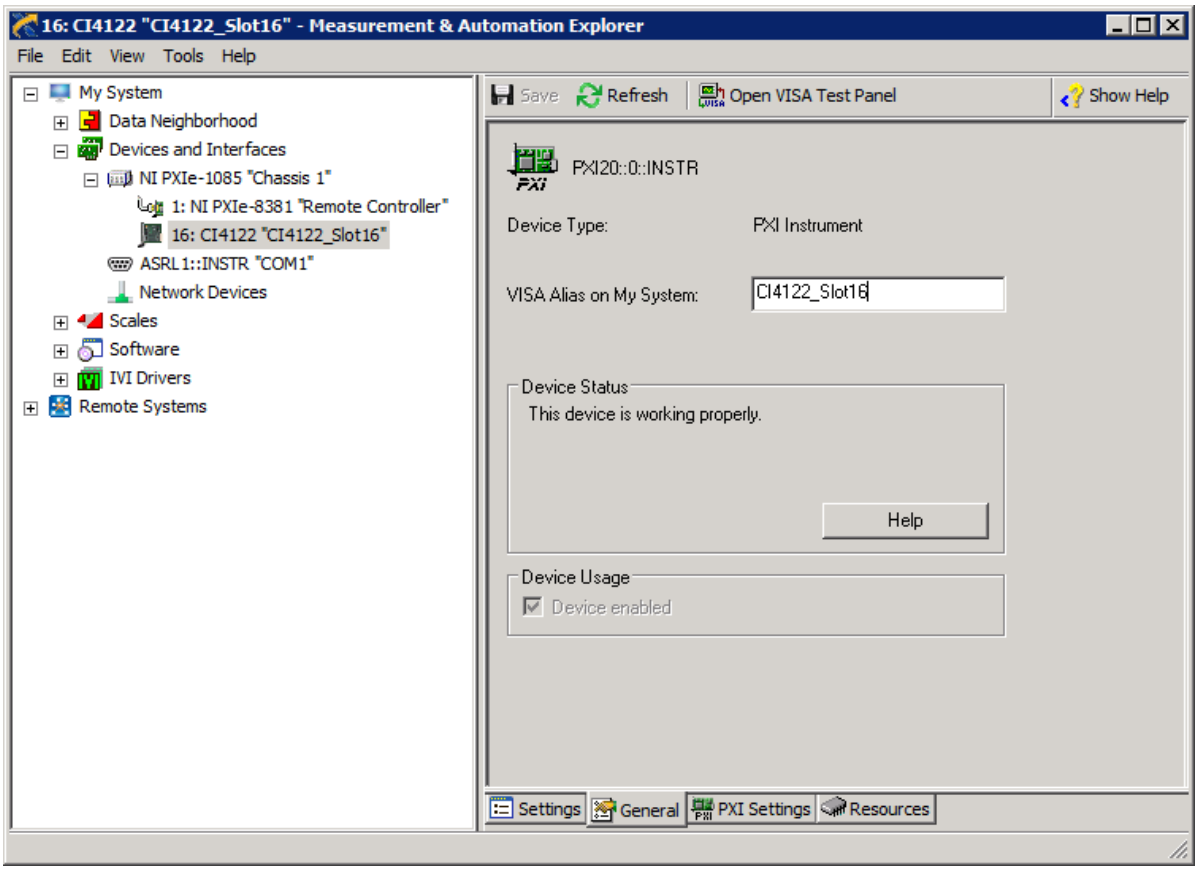

Figure A.1: NI MAX utility window.

You can assign a VISA Alias to make the name easier to remember than "PXI20::0::INSTR." Also, the "PXI20::0::INSTR" can change if other instruments are added to or removed from the chassis or computer. (Note the slot number in the name will be inconsistent if the board is moved to a different slot.)

Back on the left side, expand "IVI Drivers" and "Driver Sessions."

Add a new driver session by right clicking on "Driver Sessions", Figure A.2. Give this a name which is helpful to you for identifying this specific piece of hardware.

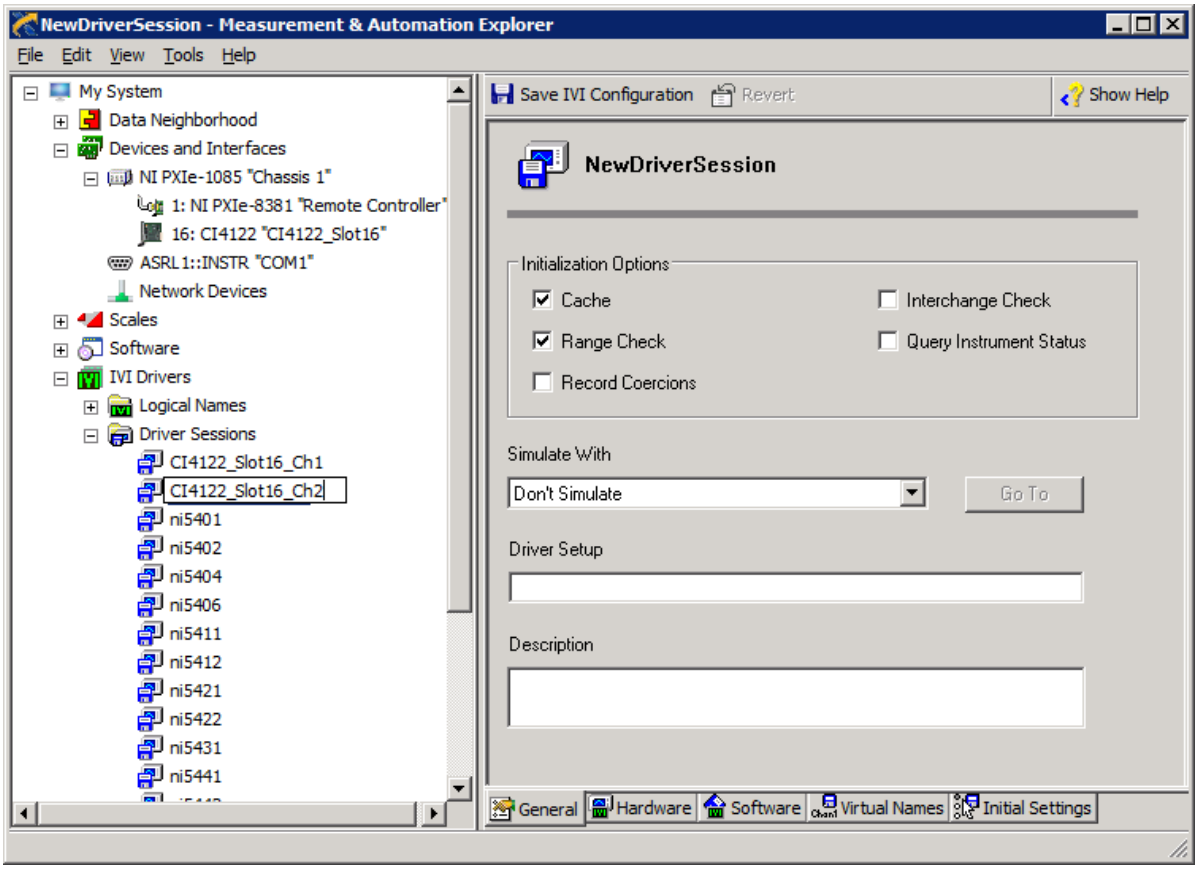

Figure A.2: New Driver session in NI MAX utility window.

To select channel 1 or 2, enter "Channel=<n>" in the "Driver Setup" box, Figure A.3.

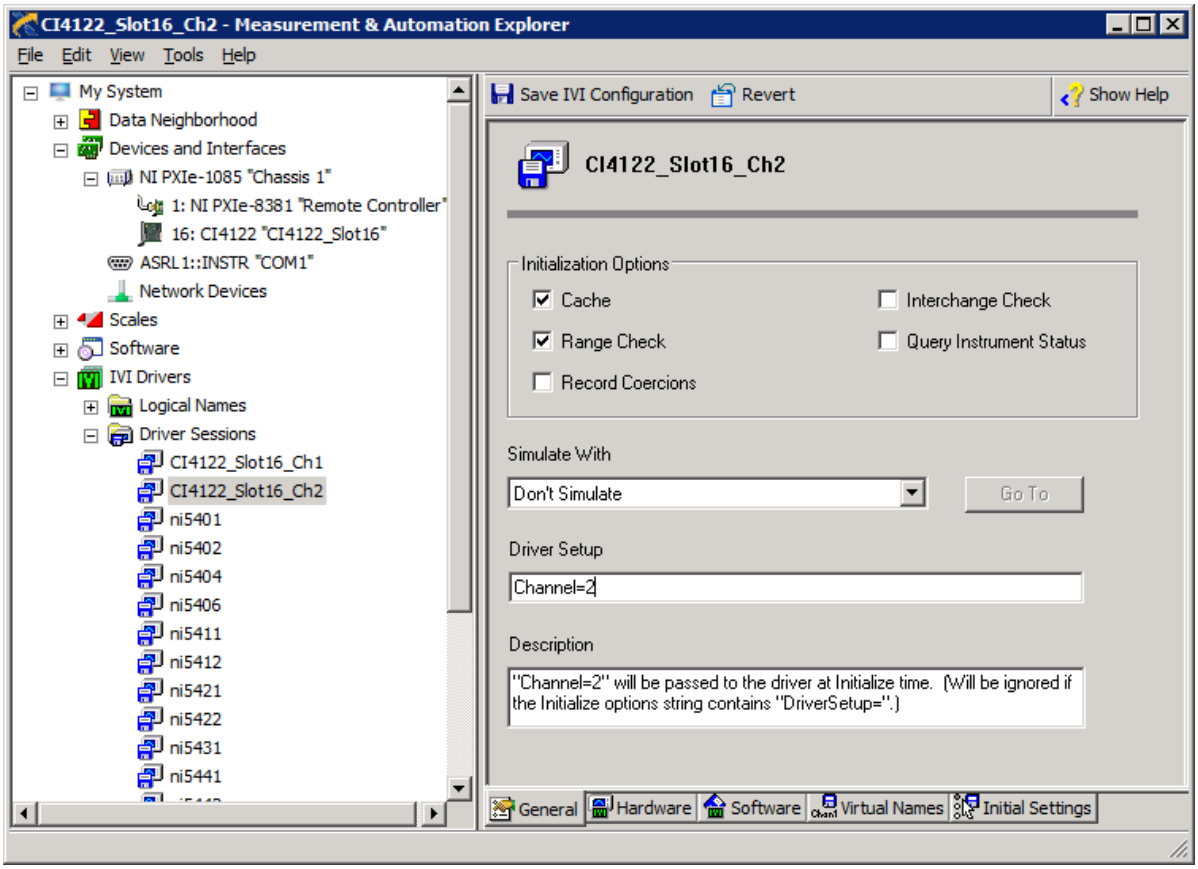

Figure A.3: Selecting the right channel for CI4061/4062/4122 module.

Now, select the "Hardware" tab on the bottom of the window, Figure A.4.

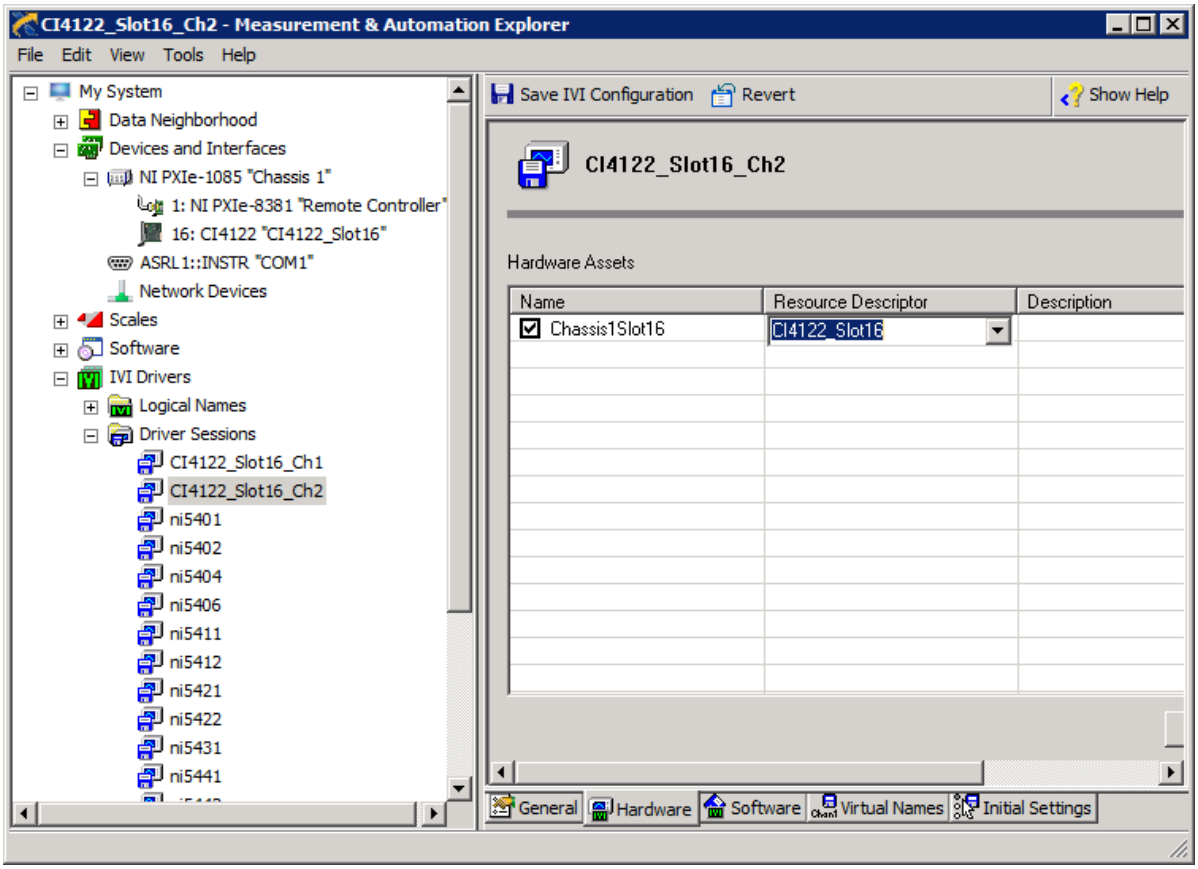

Figure A.4: Hardware Tab.

Select the hardware (here shown by its VISA Alias assigned above) using the drop down box which appears if you double click in the "Resource Descriptor" column.

IMPORTANT: "Check" the box on the left or the hardware will not be found.

Select the "Software" tab on the bottom of the window, Figure A.5. Select the CI4000 driver from the drop down list. You

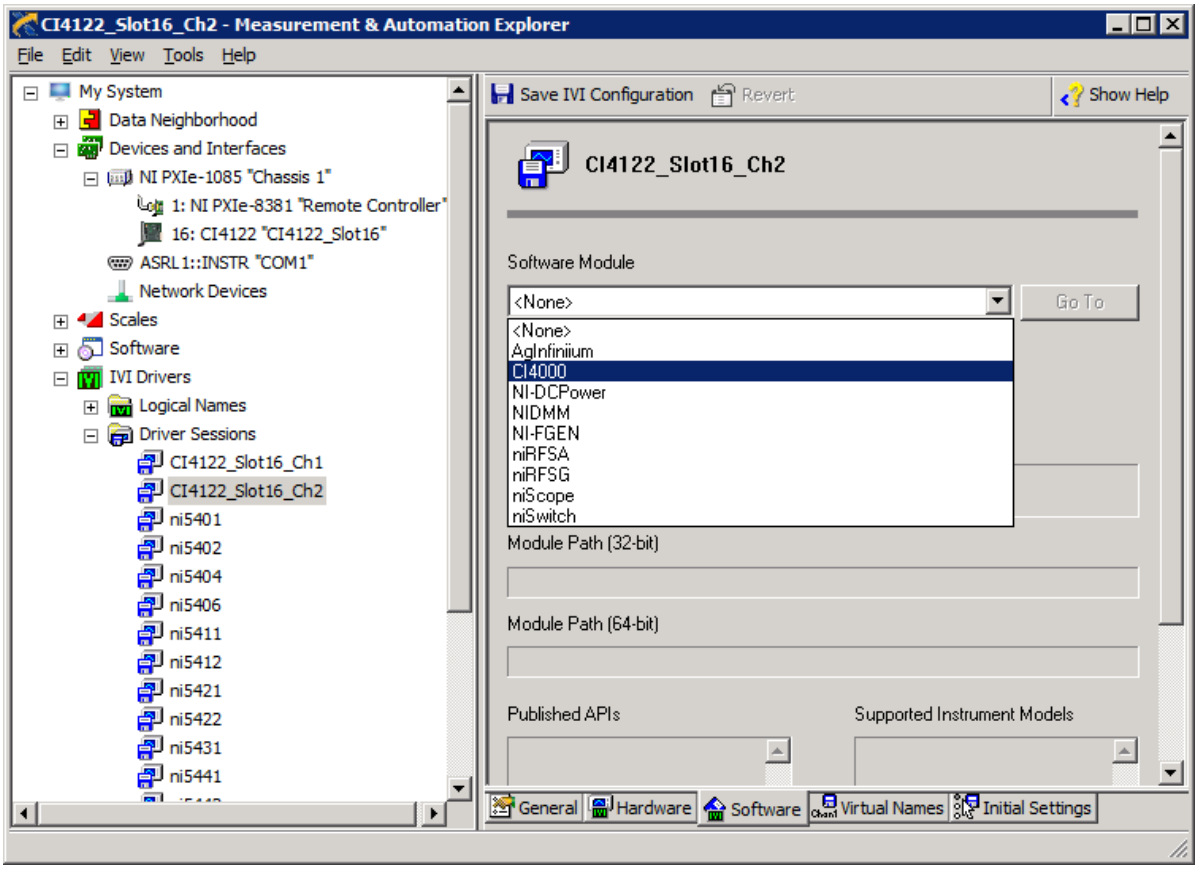

Figure A.5: Softwware Tab.

can use the generic "IviRFSigGen" interface, but this connects it to a specific driver.

The Virtual Names tab does not apply to the CI4000 as it does not have any repeated capabilities. (Note the IviRFSigGen definition does not provide for Channel as a repeated capability.)

The Initial Settings tab does not have anything to point out yet.

We are done with setting up the Driver Session. Now we need to refer to it with a "Logical Name" which we will use in our program.

Back on the left side, expand "Logical Names", Figure A.6.

Right click on "Logical Names" to create a new name and give it a name that is meaningful to your application. In the

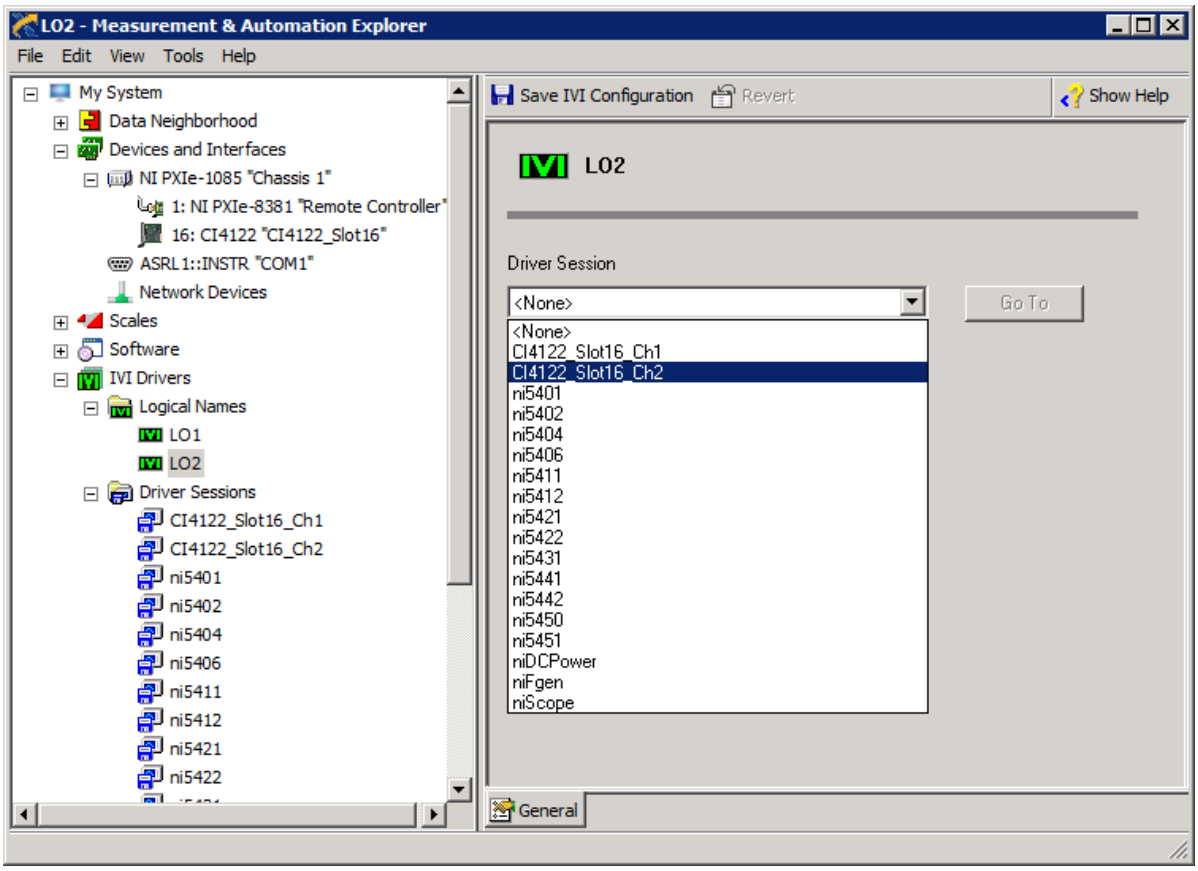

Figure A.6: Logical Names in NI MAX utility.

right window, the "Driver Session" drop down allows you to select the Driver Session you just created.

Now in the Initialize function, you can specify "LO2" for the ResourceName argument.

So long as you don't override it with the Initialize OptionsString, the channel is already selected.

If you change your cable routing, you can go into NI MAX (the IVI Configuration Store) and swap the Driver Sessions behind the Logical Names potentially without having to change your program.

Troubleshooting

If the CI4000 is installed in the system but does not appear in NI MAX:

- Did you install the driver?
- Did you reboot the PC after turning the chassis on?
- Does it appear in the Windows Device Manager?

Appendix B

LabVIEW™VI Installation

To install LabVIEW VIs and examples you need to copy 'CI4000 VIs' folder to LabVIEW user libraries folder 'user.lib'. Figures B.1-B.6 provide the steps to accomplish that. It is assumed that the default file locations were used during the installation of LabVIEW and CI4061/4062/4122 drivers. If you changed the installation locations then you should use these locations instead of the default ones.

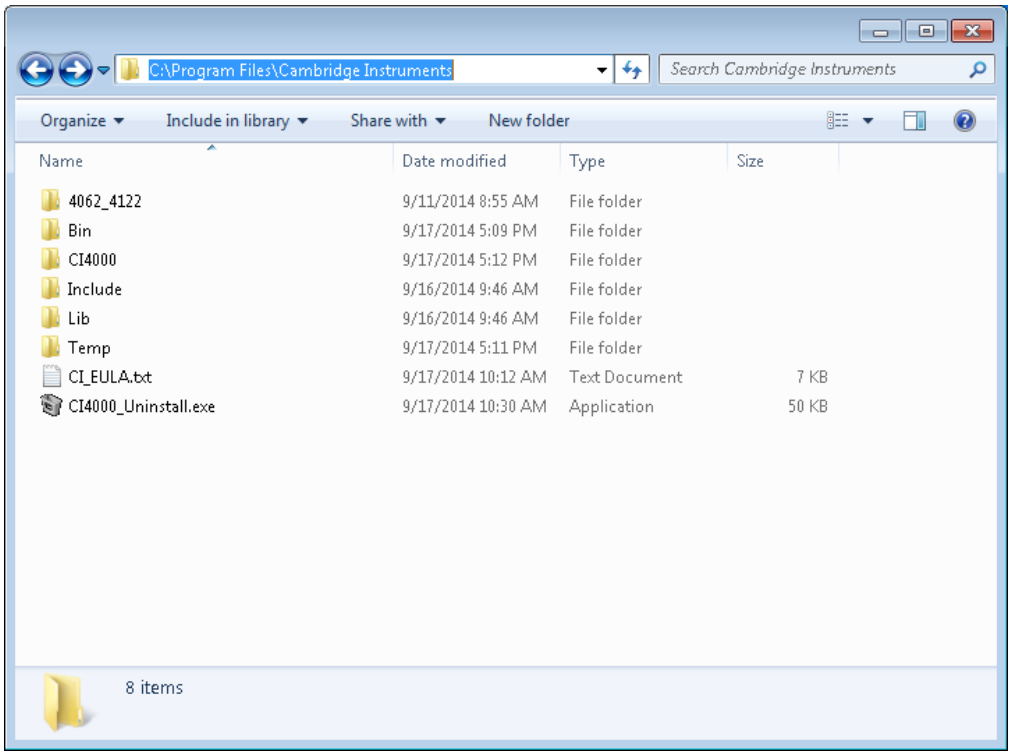

Figure B.1: Open the Cambridge Instruments Directory

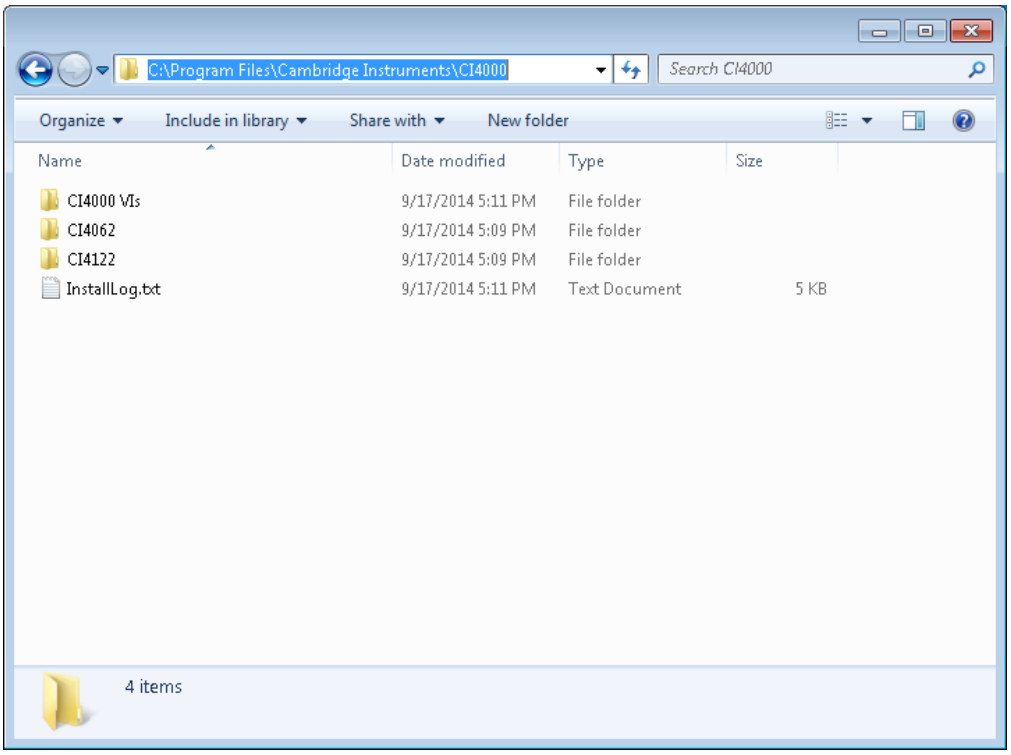

Figure B.2: In the directory you should see 3 folders labeled CI4000 VIs, CI4062, and CI4122. CI4000 VIs is the folder that contains all of the LabVIEW files.

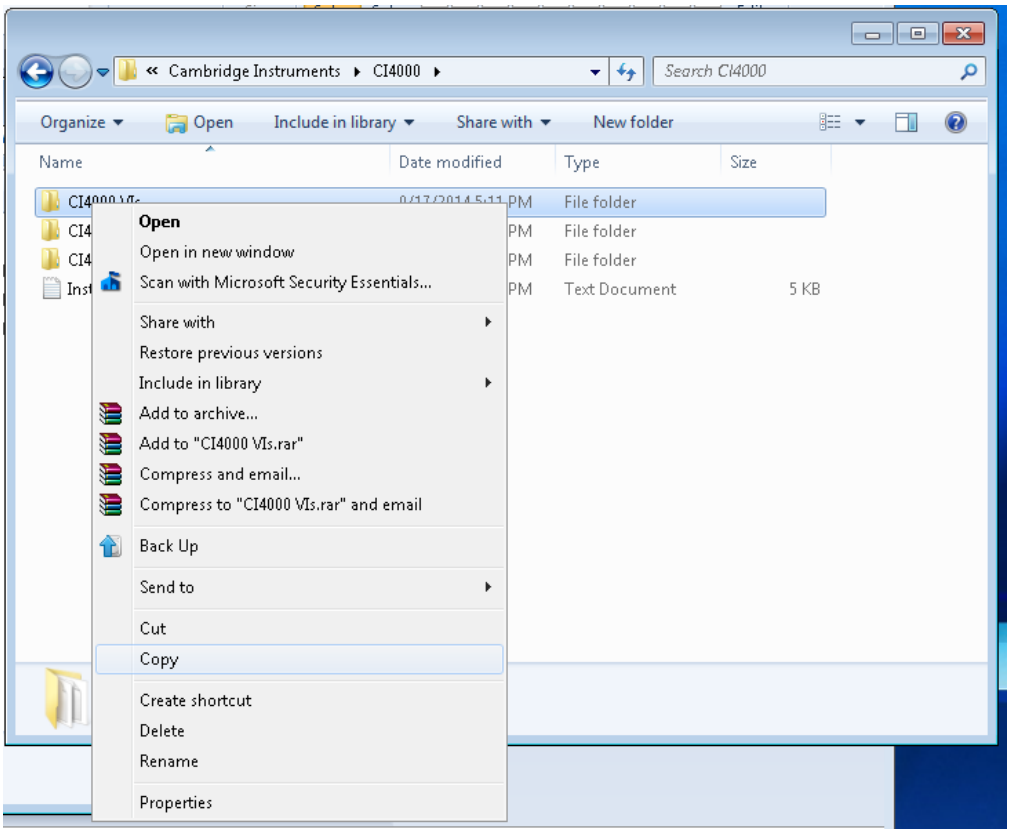

Figure B.3: Copy the CI4000 VIs directory.

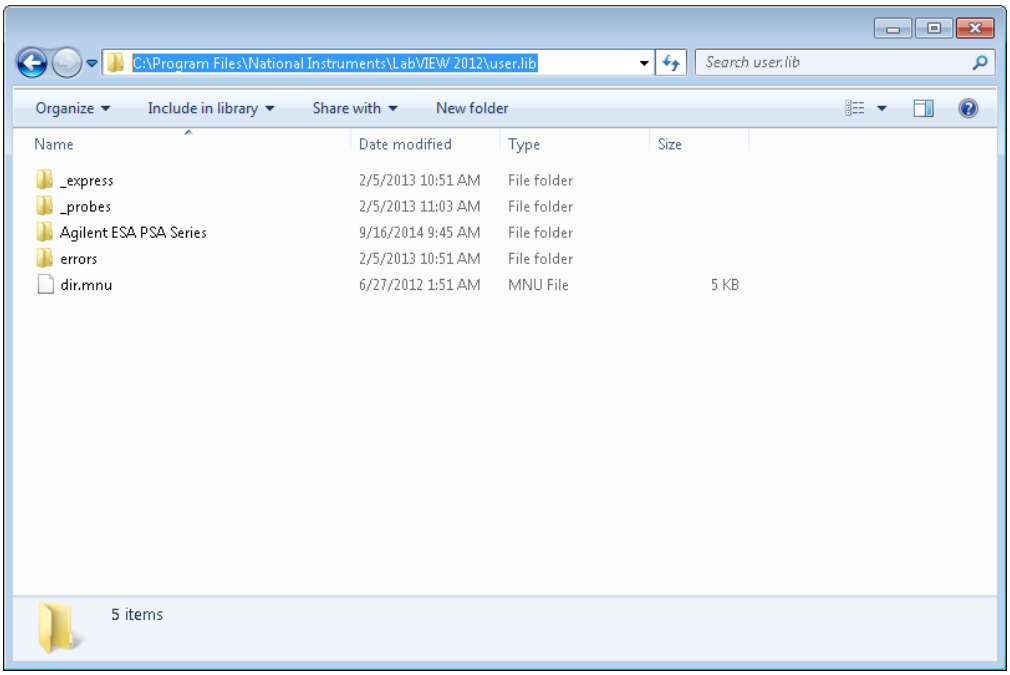

Figure B.4: Open the LabVIEW root directory. This should be in "C:/Program Files/National Instruments/LabVIEW 2012/", but also might differ based on operating system and version of LabVIEW installed.

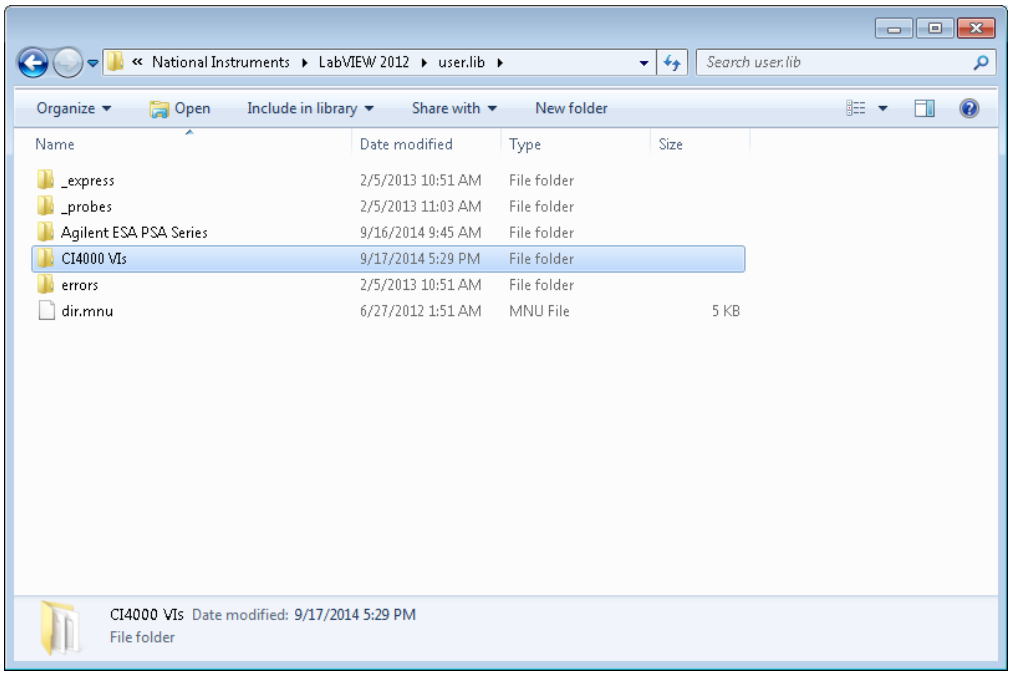

Figure B.5: Open the 'user.lib' folder, and paste in the "CI4000 VIs" folder copied earlier.

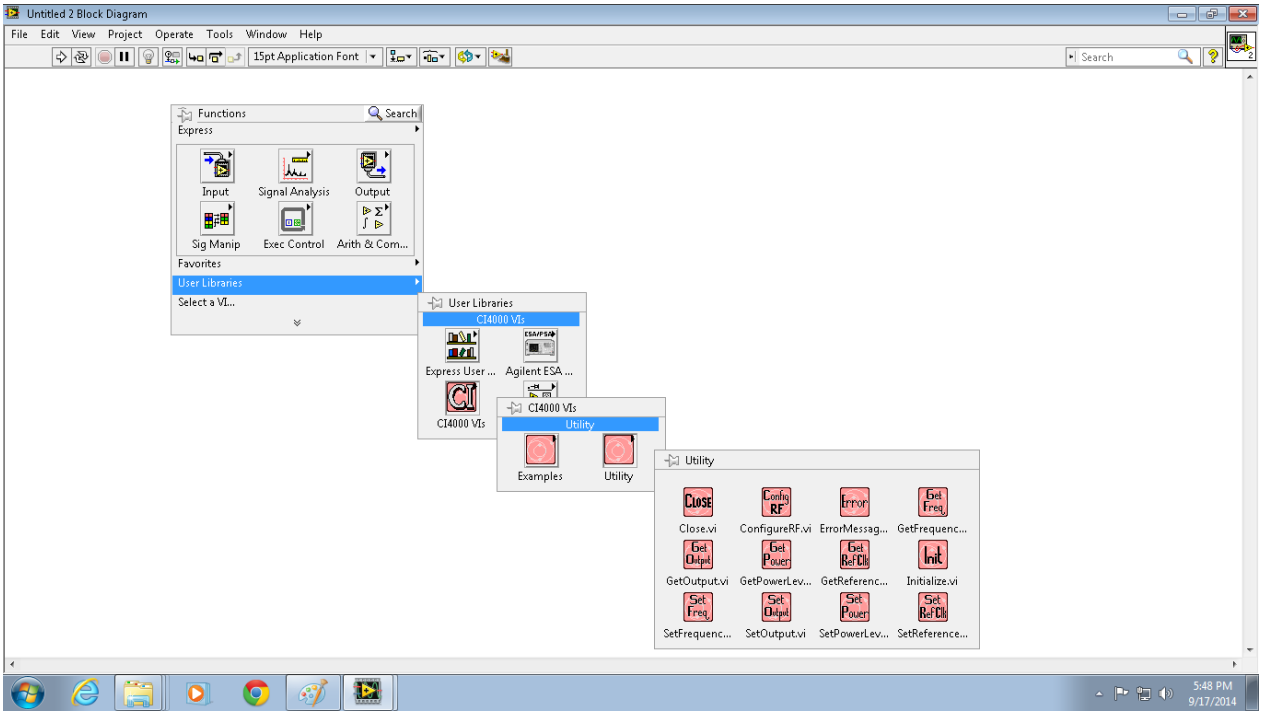

Figure B.6: Open LabVIEW, and right click on the Block Diagram. Under User Libraries you should see CI4000 VIs as an option now. This is where all of the VIs created for CI4000 are housed. Any functions not covered by the icons can be called using the .NET properties and invoke blocks. Refer to IVI documentation for more on using those.

Sales:

Cambridge Instruments,
330 Changebridge Rd, Suite 101,
Pine Brook, NJ 07058 USA
www.cambridgeinstruments.com
Tel: +1-617-863-7948
Email: sales@cambridgeinstruments.com

Service:

Cambridge Instruments,
11 Ward Street, Somerville, MA 02143
www.cambridgeinstruments.com
Tel: +1 617-863-7948
Email: support@cambridgeinstruments.com